

Star Wars software bound to fail

by Scott Wilson

Is Star Wars a fantasy or a reality?

Amid the myriad political and technical problems involved with SDI lies the simple question: will it be possible to develop the computer software needed to coordinate this massive project?

Peter Grogono of Concordia University addressed this question on February 13th.

Grogono began his talk with an overview and history of programming, in particular, the stages that have led up to the present day ideas of software engineering. As

Grogono explained, initially programming was regarded as a type of magic, where algorithmic incantations were recited over the computer caldron with the hope of producing the desired results.

As programmers progressed they began to view their activities as being more creative, speaking therefore of the *art of programming*. The process became more defined and was termed the *craft of programming*. Now that the projects are growing larger and the programmers becoming more sophisticated, they talk of *software engineering*.

In keeping with this new idea, Grogono outlined the stages large computer programs go through as an engineering project. First, the requirements and specification of the problem are established. Second, these are translated into a design (i.e. an algorithm) and the design is then implemented. The next stage involves testing and maintenance. The final stage, which includes accommodating changes in the requirements and fixing bugs that crop up after programme installation, accounts for 70 per cent of the overall cost of the programme.

It is here that Grogono claims the engineering analogy breaks down. If a civil engineer was to tell you that you could expect 70 per cent of the actual cost of a building to involve its upkeep and redesign after delivery, you would probably look for a new engineer.

To emphasize the difference between software engineering and most other engineering areas,

Grogono cited a survey conducted by the American military. It showed that close to 80 per cent of all software commissioned by the military was never put to use. Either it was not delivered or could not be used as delivered. In fact only 1.5 per cent of all software commissioned could be used as delivered. The rest required some modification before being put into service.

What of the specific requirements of the software for SDI? Since most of the problems are functions of size, Grogono began by demonstrating the relative size of the programmes required. The figures given were in Lines of Code (LOC), and although this is how programme size is generally measured, Grogono did admit that it has little to do directly with the quality of the programming since better programmes are generally smaller.

He said a typical graduate thesis project would be 5,000 LOC, representing approximately one person-year worth of work. A typical industrial programme is 10,000 to 50,000 LOC. Computer aided design and manufacturing programmes are generally one million LOC and the largest programmes to date are telecommunication programmes that use about 10 million LOC.

SDI software is estimated to require 100 million LOC. Grogono explained that "This would be a stack of paper 700 feet high, or as so-

meone once said 'we are not talking boxes of paper, we are talking box-cars'."

Grogono pointed out the problems with a programme of this size. Excellent software averages one error every 1,000 lines. That would be 100,000 errors in a project the size of SDI. More importantly, he claimed that a ten-fold increase in the size of software has generally brought to light entirely new types of software problems. This means it will require more than a lot of programmers working overtime.

To give an idea of where and why these errors occur, Grogono again returned to engineering. Computers and their software are discrete systems, that is, they have a finite, if large number of states where environmental conditions cause changes from one state another. This is in contrast to continuous systems where output varies continuously with input.

It is the interactions between the states that cause problems for software engineers, mainly because there are so many states and thus so many interactions. Grogono claimed that a programme with ten components would have 50 possible interactions, while the telecommunications programme has 30,000 components and 450 million interactions. There is not much hope of exhaustively testing all the interactions.

Grogono did not claim that the proponents of SDI were blind to all of these concerns. Rather, he outlined four of the most commonly given solutions and why, in his opinion, they will not work. These solutions are testing, simulation, verification and artificial intelligence.

Testing involves using sample or test data to search for bugs in the programme. Though generally a good procedure, and commonly used, Grogono reminded his audience that computer programmes, like

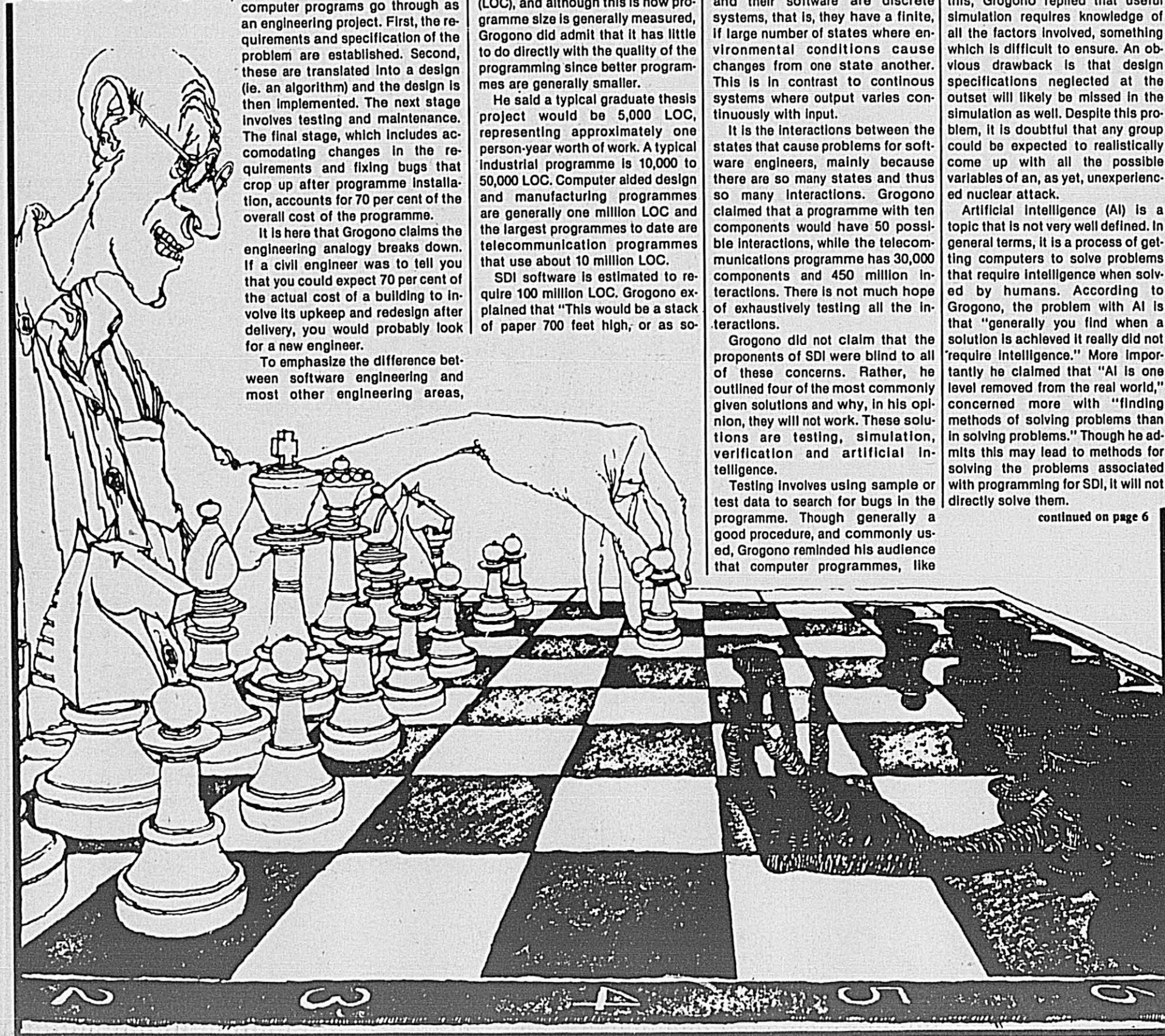
most things, fail most often and most dramatically when stressed.

Such stressful conditions would not be studied with the testing that is proposed, which largely involves tracking rocket launchings of the USA and the USSR or conducting pretend firings of Intercontinental Ballistic Missiles. Grogono said a true test of the system would require the USA to launch a realistic looking attack on the USSR. How the Soviets would react when told that they are to ignore this test is anybody's guess.

Simulation involves using a second computer system to generate dummy data for the SDI system. To this, Grogono replied that useful simulation requires knowledge of all the factors involved, something which is difficult to ensure. An obvious drawback is that design specifications neglected at the outset will likely be missed in the simulation as well. Despite this problem, it is doubtful that any group could be expected to realistically come up with all the possible variables of an, as yet, unexperienced nuclear attack.

Artificial Intelligence (AI) is a topic that is not very well defined. In general terms, it is a process of getting computers to solve problems that require intelligence when solved by humans. According to Grogono, the problem with AI is that "generally you find when a solution is achieved it really did not require intelligence." More importantly he claimed that "AI is one level removed from the real world," concerned more with "finding methods of solving problems than in solving problems." Though he admits this may lead to methods for solving the problems associated with programming for SDI, it will not directly solve them.

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Erratum:
McGill Nightline's hyde park of February 12 should have asked readers to phone 392-8234 Monday to Friday between 9h00 and 3h00, Saturday and Sunday between 18h00 and 3h00. The Daily regrets the error.

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GIVE...It's Blood Simple

Nuclear energy and the relative evil

by Michael Finkelstein

Science plays a major role in society in its development of practical, energy producing mechanisms. Ideally, scientists would like to discover a renewable energy resource which, when used, would have no undesirable side effects to its users or the environment. Unfortunately, at present there exists no such resource. In choosing an energy producing mechanism we must therefore decide between the lesser of two evils.

The criterion used to judge an energy resource has predominantly been a financial one. Only in the case of nuclear energy has the main concern of the general public been one of environment and user danger. While the potential for this danger does exist, perhaps the great concern with it has overshadowed many of the positive aspects of nuclear energy and the nuclear energy programme, especially in Canada.

Canada's nuclear energy programme began in 1945 with the construction of the Zero Energy Experimental Pile reactor (ZEEP), in Chalk River, Ontario. It was a barebones reactor which served as a pathway for the reactors which were to follow. In 1947, by a much greater technical feat, Canada built the National Research Experimental reactor (NRX), also at Chalk River.

The NRX reactor had many unique features and served as an excellent research tool for Canadian scientists. Ontario was faced with a growing demand for electric power while having a shortage of conventional natural resources. The NRX reactor demonstrated that nuclear energy was a cost effective, as well as a functional, power source given the constraint of the Ontario predicament.

The last reactor to be built at the Chalk River site was the National

Research Universal reactor (NRU), in 1957. This reactor is still functional and is used to produce medical radioactive isotopes as well as electrical power.

Given the experience Canadian scientists gained through the development of the ZEEP, NRX and NRU reactors, designs were underway for the CANDU reactor project. It was hoped that Canada would be able to sell world class nuclear reactors in a highly skilled and competitive market. The results of this

results depends on the efficiency of the energy conversion process.

A hydroelectric dam converts the potential energy stored in moving bodies of water into electrical energy through the use of electrical generators, similar to the way that water wheels are used to power many devices.

Nuclear reactors function by basically converting energy stored in a uranium atom into heat energy. The heat energy is then used to power a motor similar to a steam

would have to be burned to produce an equivalent amount of energy.

The common denominator of these three energy conversion processes is that they all produce some form of waste. Nuclear energy results in the production of very small amounts of highly radioactive material. The burning of coal or oil results in relatively large quantities of acid gases and ashes. Where nuclear power plants are obligated to safely store their radioactive waste, coal burning power plants

tive waste to fill about three subway cars. The burnt ashes from coal burning would have filled about the equivalent of 90,000 of such subway cars.

In order to store nuclear waste products scientists take advantage of many of the properties of radioactive waste. Namely radioactive waste is incapable of radiating through lead or beyond 10 feet of water. The second property has unfortunately prompted the American and British governments to dump radioactive waste into lakes and oceans, although this carelessness has not surfaced in the Canadian nuclear programme.

Nuclear waste in Canada is stored in isolated areas in (wo)man-made water reservoirs. The waste is carefully monitored and much research is done regarding the waste in hopes of recycling certain valuable radioactive isotopes.

Work being done at present seeks to mix the waste with a glass refractory resulting in a form of glass waste. This waste would have the property of being virtually unleeching, meaning that it may be buried with little danger of it penetrating its natural container.

This waste is then hoped to be buried in one of the 1,000 potential locations across the Canadian Shield. These sites are known to have been geologically stable for billions of years. A single vault in one of these locations would be able to hold all of the nuclear waste produced in Canada for the next 50 years.

Where the idea of burying nuclear waste may at first appear to be very unattractive, we must consider the alternatives available. As mentioned before, the burning of oil or coal results in massive quantities of acid gases and ash. Acid gas is a difficult pollutant to control; it is also difficult to track down the source of this pollutant. This makes it a very undesirable energy production byproduct.

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attempt have been very successful, making CANDU nuclear reactors a respectable world competitor in the field. Six of the top ten most efficient nuclear reactors operating in the world today are CANDU reactors.

Most energy producing stations function by converting some energy source into electricity. Essentially the source is said to contain an amount of potential energy, where the amount of electrical energy that

engine which drives an electrical generator, resulting in electrical power.

What makes nuclear energy so attractive is that minute quantities of uranium can be converted into very large quantities of electrical energy. For example, a 25 kg fuel bundle in a CANDU reactor can satisfy the electrical power requirements of an average Canadian family for about 100 years. Fifty tonnes of coal or 450,000 litres of oil

freely emit the acid gas byproduct, only to have it later precipitate to the earth's surface in the form of acid rain or snow.

Had Ontario Hydro used coal burning plants to produce the amount of electricity generated by their nuclear plants to date they would have emitted four million tons of acid gases into the atmosphere and would have produced some nine million tonnes of ashes. Instead, they are left with enough radioac-

Killing PCB toxins proves tricky and expensive

by Susan Himel

Last week the Dow Chemical Company was fined \$17 000 by the province of Ontario for its huge spill of toxic material into the St. Clair River. This most recent incident raises some important politically and economically volatile issues. Government planning and legislation as well as industrial responsibility and involvement in dealing with the problems of pollution are now of unavoidable concern.

There has been a marked increase in the general public concern and awareness of toxic waste production and more recently, its management. While accidental spills frequently appear on the headlines of national newspapers, few people are aware of the evolving legislative and legal developments concerning toxic waste management or the available technological solutions at the industrial level.

In general, polychlorinated biphenyls (PCBs) are stable, non-corroding, non-flammable compounds having a low solubility in water and strong adhesive properties. Hailed as the wonder chemical

of the future with the commencement of their production in 1929, PCBs were used extensively in industry as insulating fluid in the fifties and sixties.

It was not until the major poisoning of about 1000 people in Yusho, Japan in 1968 from rice oil contaminated by PCB heat exchange fluid that the environmental dangers of PCBs were revealed.

In North America the sole producer of PCBs was the Monsanto Chemical Corporation. They placed a voluntary ban on their sales in 1972. The manufacture of PCBs was finally banned in 1977.

Since that time, regulations under the Canada Environment Contaminants Act have prohibited any further usage of PCBs except in existing electrical equipment operating prior to the date of the ban (July 1980). Meanwhile over fifty per cent of existing PCBs remains in electrical equipment worldwide.

When released into the environment, PCBs begin disrupting photosynthesis in microscopic plants. These plants are the foundation of all aquatic life. As a result of their inherent stability, the PCB concentrations tend to increase as they travel up the food chain from one life form to another

(biomagnified).

In humans, the PCBs may be inhaled and absorbed through the skin or consumed from plants, fish and animal sources and are stored and accumulated in the fatty tissues. Unfortunately, it is not yet conclusive as to whether the PCBs stored in our bodies through the food chain are doing us harm, despite the clear evidence of their presence.

Nevertheless, the recognized PCB hazard is finally being addressed in an effort to arrest further spread and bring about their eventual elimination. The debate raises questions of the utmost sensitivity and concern for governments, industries and private citizens.

To arrest the input of PCBs into the environment, restrictions are now being imposed on the storage, handling, and disposal of wastes. At the same time, the development and application of available advanced technologies are being studied and utilized for PCB waste destruction and disposal.

High temperature incineration is presently the most effective method identified in destroying PCBs. The efficiency is approximately 99.9999 per cent. Because of public objections regarding the

dangers of possible toxic emissions during incineration, such full-scale destruction facilities have not been approved for installation in Canada.

Present alternatives to the incineration of PCBs include the chemical treatment of the contaminated liquids and solids. One such sodium-based process that removes PCBs from oil by conversion to sodium chloride has been developed by PPM Inc.

This process operates at ambient temperature in an oxygen-free atmosphere without flammable



solids. Accordingly, the firm says, chlorinated and non-chlorinated benzofurans and bezodioxins are not formed, as in the case of in-

clination. The reducing agent used is a highly complex organo-sodium reagent that is air and water sensitive. It requires the process to be blanketed in nitrogen. The reagent reacts immediately with PCBs and chlorinated hydrocarbons to form sodium chloride (salt) and a polyphenylene polymer. The oil can then be reused after the sludge is removed and sodium levels reduced.

The PPM process is by no means the only one presently developed and in commercial use. However, as David Alaniz the President of the Canadian company says, the "industrial elimination of PCBs is at least a twenty-year process."

There is much more research to be done if the accumulative and widespread presence of PCBs are ever to be removed. If the problem is to be resolved it will take extensive cooperation at all levels: government, industry and technology.

The St. Clair River blob has most clearly illustrated some of the unforeseen environmental consequences of industrial expansion and development. It has also shown how far our technical, legal and economic systems have still to develop in dealing with this most vital area of concern.

Fertile lakes foster Sockeye Salmon

by Cameron D. Eckert

In British Columbia, bigger is better.

According to John Stockner of the Department of Fisheries and Oceans, nowhere is this more true than in the Salmon fisheries. Stockner was hosted by the McGill Biology Honours Students' Seminar Series last week where he unveiled the success of the Fisheries Research Branch with respect to their work on the enhancement of Sockeye Salmon growth.

Many people are familiar, at least in part, with the fascinating life cycle of the Sockeye Salmon. The basic trend is that Salmon hatch from eggs in inland freshwater bodies where they spend up to three years. During this time they feed and gain weight in order to attain their 'smolt' size at which point fish-oriented people refer to them as *smolts*. As smolts they are able to make the trip to sea by way of outflowing river systems.

The Salmon continue life at sea for a number of years until their final dramatic act. They battle their way back upstream to that same freshwater body from whence they came, at which point they spawn and die.

is simple. The level of primary nutrients such as nitrogen and phosphorous is known to directly affect the size of the standing stock of zooplankton in the lake. Zooplankton in turn, is the primary food of young, pre-smolt salmon. Thus an increase in phosphorous concentration should translate into increased salmon growth with larger smolts heading to sea. Larger smolts experience greater survival and thus the adult salmon population should increase.

With the realization that lake fertility is a potentially key factor affecting salmon numbers, a deleterious effect of heavy salmon fishing came to light.

The coastal lakes of B.C. tend to be quite low in nutrient concentration, that is, oligotrophic. One of the major sources of nutrients to these lakes is thought to be the rotting carcasses of salmon that die after spawning. Intensive fishing means that significantly fewer salmon make the return trip to their breeding grounds. The nutrient supply that was destined for the lake ends up on the supermarket shelf.

Stockner's research has concentrated on the enhancement of salmon growth through the artificial

determine what he had been hit with, Stockner replied, "you've been fertilized."

A number of McGill limnologists (lake biologists) present at the lecture raised concerns regarding the potential impact of the artificial phosphorous load to the lake ecosystem. Specifically, the near-shore area of the lake (littoral zone) could experience algal blooms which could adversely affect other organisms sharing that portion of the habitat. Stockner waxed the questions eloquently only to reveal that in fact he did not have an answer to that question. He suggested that since the air-drops avoid the near-shore area, then the impact should be reduced.

Finally, Stockner presented hard evidence that seemed to support the success of the whole-lake fertilization project. He indicated that

the number of Sockeye Salmon caught in the ocean areas around the entrance to the spawning routes of fertilized lakes has increased up to ten fold over the ten years that this project has been operating. The data were indeed impressive although those in attendance did not seem entirely sold.

What is the future of the fertilization programme? Ideally one would hope that the salmon population would stabilize at its current high numbers and that the intensive fertilizations could cease. In reality, Stockner conceded that as the fisher(women) have come to enjoy the abundant crop, the government does not wish to halt the programme and risk a crash in the salmon population. So in the land where bigger is better, fertilizations continue.

The u

by Monica Vetter

An explorer trekking across the surface of the human brain in hand, can be forgiven moments of doubt and confusion. The details of the map are constantly shifting.

The major landmarks change. From person to person there is remarkable regularity in the way the cortex folds into recognizable ridges and grooves. One is actually able to identify areas of the brain involved in processes such as vision, memory, speech, and sensation by looking at these folds.

Within each of these 'folds'

Canada's water is

by Margaret Ann Moote

Robert Bourassa, Thomas Kierns, Simon Reisman and certain other Canadians support diversion of Canadian water to the United States only because they will receive personal economic gain from such schemes at the taxpayers expense, according to Richard Bocking.

Bocking, a television producer who has been following the water export issue for seventeen years, spoke to a small group at McGill on February 13 about the potential for large-scale Canadian water export.

Bocking suggests that "to establish a market in any commodity, there must be a buyer who needs it, and a seller who has more than he needs." Economists promoting water export have made no mention of market costs, prices or demand. Bocking believes there is no water shortage in the USA. He also questions whether a Canadian surplus exists, and whether Americans could ever pay the cost of the proposed water export schemes.

There has been no comprehensive study of water supply in the USA which has concluded that there is or will be a need for imported water.

What does exist is irresponsible water wastage and pollution. Excessive pumping of groundwater and heavy polluting deplete available water supplies. The effects of such water mismanagement have given rise to, what Bocking calls, "the crisis school of thought" to predict imminent and drastic water shortages in the USA.

The predictions are based on extrapolation of current trends in water use. The average per capita consumption in the USA is three times that of Britain or Sweden. Old delivery systems in the USA lose 10 to 50% of transported water to leakage. Perhaps even more alarming are American water laws, which encourage excessive water use.

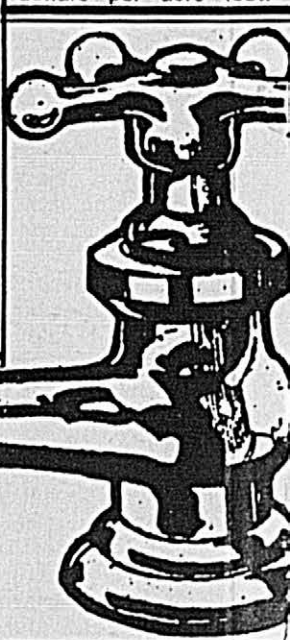
Bocking pointed out that forecasts predicting disastrous water shortages in the USA by the end of this century are based on projections of present growth and consumption rates. The effect of future conservation and improved recovery are ignored.

Bocking is optimistic that as society continues to become conservation-minded, political conception and laws will change. His attitude is unusual among the more popular forecasts of doom by water managers.

While Bocking may consider the issue of water export to the USA completely unfeasible, many others do not. The National Resource Council recently awarded Thomas Kierns' engineering firm \$30,000 to begin work on his *Great Recycling and Northern Development* project (GRAND). Bocking noted the funding was granted "over the objection of almost every professional in the field of water policy in Ottawa."

The proposed GRAND scheme would move water from James Bay to the Great Lakes, at an initial development cost of \$100 million. James Bay would be dammed where it enters Hudson's Bay, to keep the fresh water flowing into it from mixing with the salt water of

of the canal system alone is estimated to cost \$1,000 per acre foot, (the amount needed to irrigate an acre a foot of water). quoted studies showing maximum American could pay for water would be dollars per acre foot.



presents this as evidence of massive water diversions never pay for themselves.

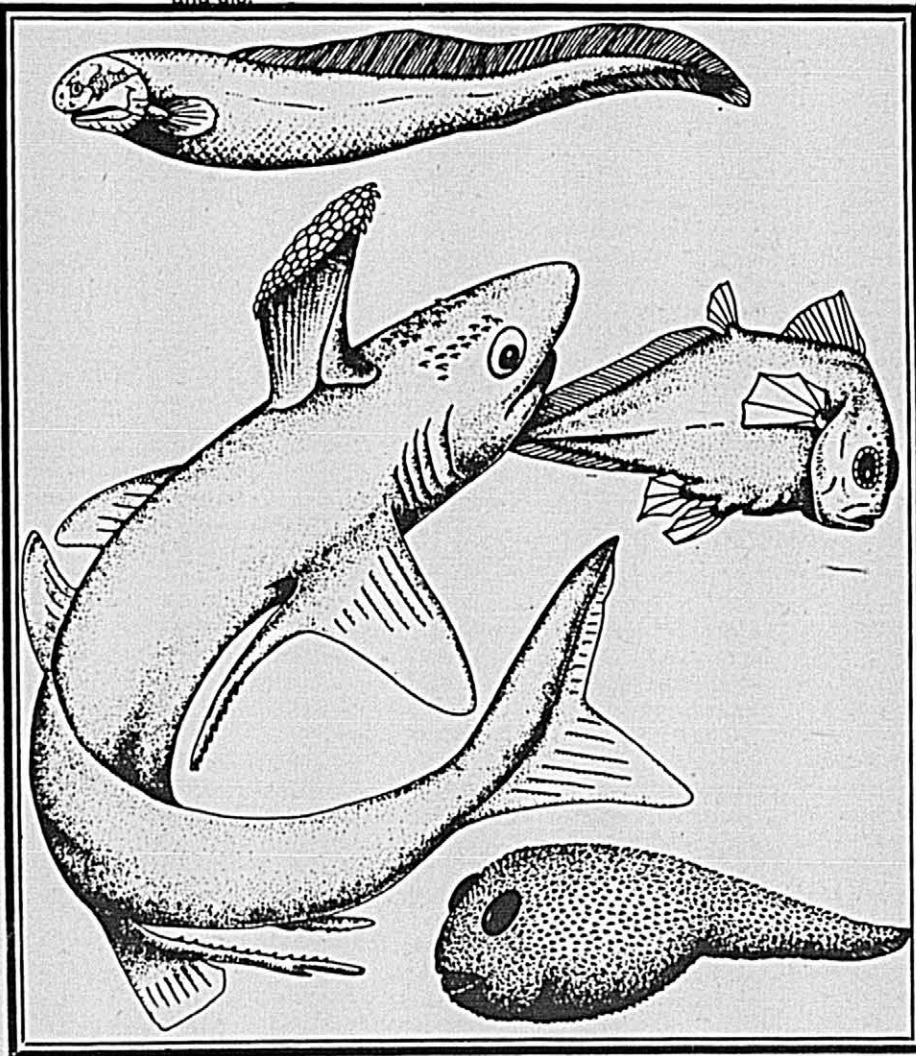
No study of the environmental or social costs of large scale basin water diversions has been made. Bocking quoted experts on various fields who have assessed the possible effects of such schemes.

The concept that fresh water flowing into James Bay is lost to the salt water in Hudson's Bay ignores the ecosystem's dependence on freshwater to maintain the salinity to which they are adapted.

Developers often argue, as the audience did, that water would drop very little in the rivers affected by the constant flow. Bocking replied that most of the water is lost around rivers and depends on the productive use of wetlands at the land-water interface. It is precisely this area that would be affected by slight level drops.

Much smaller scale diversions such as the Churchill Dam in Manitoba, the Ben Lomond Dam in B.C., and the James Bay hydroelectric development in Québec had severe effects on local wildlife and the native population dependant on it.

Bocking stressed that the effects of much larger schemes such



It has been shown that larger smolts experience substantial increases in survival to adulthood. Hence Stockner asserts that in true western style, bigger smolts are better smolts. Fishery biologists have tuned into this trend with the logical conclusion that if one could increase smolt size, then there would be a greater survival amongst Sockeye Salmon. An increase in survival means more fish available for Canadian fisher(women).

Stockner reasoned that the fertility of a lake would affect the size of the smolts that venture seaward from that lake. The logic behind this

fertilization of coastal lakes in B.C. Stockner explained that addition of nitrogen and phosphorous to certain lakes has increased organismal production with larger standing stocks of those vital zooplankton. He found that this led to increased in-lake growth of juvenile Sockeye Salmon and thus larger sea-bound smolts.

The fertilization is achieved through air-drops such as one would expect to see when a plane is fighting a forest fire. The only public outcry came when a canoeist happened to be enjoying a paddle during this process. When the individual contacted Stockner to

Hudson's Bay. What is now James Bay would then be drained by a series of canals and reservoirs leading to the Great Lakes.

The GRAND canal project is estimated to require 100 000 megawatts of energy to pump the water uphill from James Bay to the Great Lakes. Coincidentally, the James Bay Power Project produces 100 000 megawatts annually. The water would then be pumped from the Great Lakes system, through a similar canal-reservoir linkage to the arid southwest USA.

Water from the American stretch

Unchartable terrain of plastic brains

areas' there is a specific pattern of organization. The result is an elegant functional 'map' which varies in detail from person to person. Is this brain organization genetically programmed, or does experience play an important role in deciding how these patterns are established?

Mike Merzenich, a neuroscientist from the University of California at San Francisco, has brought us a few steps closer to answering this question. He has discovered that this organization not only varies from person to person, but can change over time in the same individual, depending on the strength and timing of inputs to the cortex.

His recent findings were the subject of a lecture at the Montreal Neurological Institute on Monday, where he addressed an audience of scientists, doctors, and students. Merzenich's research is conducted on the somatosensory area, the region of the brain which receives information about touch from the body surface.

Each part of the body is represented in this area to form a sensory map of the skin surfaces. If you touch your knee, for example, you trigger a flow of electrical impulses which travel along the nerve, into the spinal cord and up the spinal columns. After several intermediate transfer points in the

'lower' structures of the brain the input finally arrives at the somatosensory cortex, causing a specific group of neurons to 'fire,' or become electrically active.

By touching a different part of the body, you can cause a different

group of cells to respond in this way.

If the map is genetically determined or 'hardwired' from an early age, the removal of inputs from the hand should simply leave part of the cortex silent or unused. However, when the hand region of

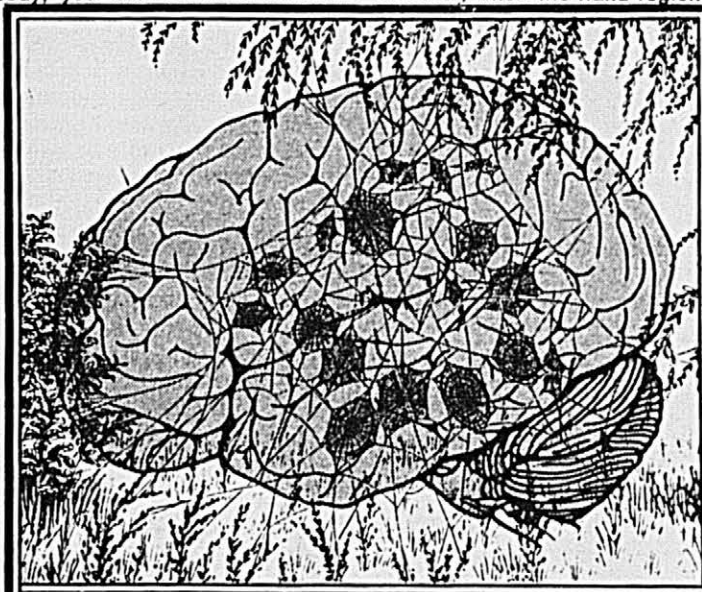
is, in fact, competition between existing input pathways to the brain at the level of the cortex. It is the relative strength and timing of the inputs which decides whether the cortex will respond to one or the other. When one source of input is eliminated the other takes over.

A piano player, for example, might have a larger part of the brain surface responding to sensations from the fingers due to the constant input from the fingers to the sensory cortex. A higher resolution of sensation, that is, a greater ability to discriminate touch at two nearby points on the skin, is obtained when the surface area of the cortex activated by inputs from a given region is increased. This may be involved on the sensory end with the acquisition of skill.

Merzenich's hypothesis begins to account for the differences in the details of brain organization from individual to individual, as well as explaining changes in this organization over time.

His ideas have received some support from work done at McGill by Dr. Rob Dykes. Dykes temporarily removed the means of competition or inhibition between inputs in the cortex using drugs. The extent of influence of a single source of input expanded greatly. The necessary widespread connections are therefore already in place.

Merzenich's findings have come at a time of change in the neuroscience community. People are beginning to realize that the brain is not rigidly organized from birth onwards. Instead, it seems to be highly 'plastic' — subject to the changing nature of the environmental influences that greet a person in the course of life.



not for sale

GRAND plan cannot be estimated based on present knowledge. He noted that the social effects on Canadians of water interdependency with the USA could be horrendous.

Two GRAND canal promoters are Québec Premier Robert Bourassa, and Simon Fiesman, who is the Canadian Advisor in the free trade talks with the USA. According to Bocking, both have said that water should be treated as an economic commodity like timber or minerals. To Bocking, this shows a "quite breath-taking lack of comprehension as to the nature and role of water."

Bocking analyzed the American market to drive home his point that Americans would never pay for Canadian water once such diversions were implemented.

As the consumer of 80% of American water, irrigated agriculture is the only conceivable market for Canadian water. Traditionally, farmers are not conservationists. Western USA prior appropriation laws give water use rights to those who first claimed the water. The laws further require that this water be used, or the right to it will be lost. As a result, farmers irrigate to their maximum allotment, often well beyond actual needs.

Water wastage by farmers is also encouraged by government water subsidy. Farmer's payments for water cover less than 10% of the actual irrigation costs. Taxpayers pay the rest, which is usually more than the market value of the crops.

Bocking pointed out that those benefiting from subsidized agriculture are not struggling family farmers, but companies such as Prudential Life, Exxon and South Pacific Railways, who have replaced small-scale farmers.

that there is a shortage of cheap water in the USA. Bocking believes that the solution to water wastage is to allow water prices to rise to the actual cost of the water. Economic pressures have been shown to induce conservation measures in household consumers and in industry.

In Edmonton, where water is metered, per capita consumption is one half that in unmetered Calgary. Raising industrial water costs has encouraged conservation technology in industry, reducing consumption by 50 per cent in some cases. In agriculture, measures such as lining ditches, implementing drip irrigation, and planting crops with low water requirements can reduce water loss up to 50 per cent.

Conservation measures are unpopular because of the immediate cost to the user. Farmers calling for importation of Canadian water are sure they would never have to pay for it. Water prices in the USA have always been based on the farmer's ability to pay, not on the actual cost of the water. Bocking suggests that this is the key to why potentially uneconomic projects continue to be developed. "The costs are dispersed over the taxpayers of an entire nation," he said.

In recent years, environmentally conscious Americans have voted down inter-basin transfers as a means of replenishing their water sources. Local conservation methods have evolved that are much less costly by all standards.

In most of the dry southwest states, water is being reallocated from agriculture to urban and industrial uses. In the cities, people are conserving more. The director of the Tucson, Arizona water department says, "Grass is obscene." In Tucson, citizens plant cacti and

group of cells to respond in this way. It is therefore possible to systematically map out the discrete regions of cortex activated by input from each part of the body surface. Our ability to localize sensations to a toe instead of a finger depends upon these patterns of organization.

But do these patterns change? If you were to lose a finger in an accident would there be a part of the cortex quietly waiting for information from this finger, but never receiving any?

In 1982, Mike Merzenich began to answer these questions. He first cut one of several sensory nerves to the hand of a monkey. Touch to certain fingers was therefore prevented

the sensory cortex was remapped a short while later Merzenich found a dramatic reorganization of the map.

The cells expected to be silent actually respond to touch of adjacent parts of the hand. Neighbouring sources of intact input expand their area of influence to take over the part of cortex abandoned by the cut-off input. Within limits, then, no part of the cortex stays unused for long.

But how does this happen? Are new connections between cells made? Apparently not. The changes happen so quickly that there is no time for significant growth to take place. The fundamental connections must already be in place.

Merzenich speculates that there

New intelligence centre

by Mark Ramsay Attisha

Cognitive Science is the new wave in brain and behavior research.

This rapidly growing discipline draws together such disparate studies as anthropology, computer science, education, electrical engineering, linguistics, philosophy, psychology and sociology.

Cognitive Science (CS) is the study of thinking. Artificial intelligence, automated reasoning, cognitive modelling, cybernetics, expert systems, psychophysics, robotics and sensible software all fall within the rubric of this exciting new field.

The McGill Cognitive Sciences Group has been in existence for over five years and through its colloquia and Workshop Series, funded by the Alfred P. Sloan Foundation, it has fostered a growing interest in CS work. The overwhelming response to last year's lecture by linguist Noam Chomsky, sponsored by the Group, attests to their success.

In order to focus on CS research and to pool their resources from various facilities throughout McGill, several professors, led by Carl Fredriksen, Mark Seidenberg and Thomas Schultz, have just recently set up the McGill Cognitive Sciences Centre.

"The Group's function was simply to provide a way to share ideas and be scientists," said

Seldenberg. "The Centre came about out of a need to secure improved facilities, equipment and grant support."

The Centre consists of three laboratories: the Laboratory of Human Information Processing and Artificial Intelligence, the Laboratory of Language and Cognitive Development, and the Laboratory of Applied Cognitive and Ethnographic Studies. Whereas only the third laboratory is in actual existence at this time, the other two have clearly defined goals and research interests drawn from work already underway.

The Thinking Lab

The Laboratory of Human Information Processing and Artificial Intelligence is largely concerned with theoretical models of cognitive processes. Such processes include reasoning, language comprehension, and knowledge acquisition.

Artificial intelligence research includes computer models of theorem proving, decision making, expert systems for statistical analysis, and problem solving. Perhaps the best known work in this field is Steven Zucker's human and computer vision research presently underway in the Department of Electrical Engineering.

The laboratory's goal is the acquisition of a shared LISP machine to permit collaboration in the construction of computer models and enable the interaction of theoretical modelling and experimental results.

The Language Lab

Current research at the Laboratory of Language and Cognitive Development includes text comprehension, causal reasoning, and acquisition of sign languages in children, as well as motor and social development in infants and toddlers. Neuropsychological studies of language and cognitive performance by aphasics and dyslexics are also being pursued.

The impetus for a laboratory in this field has been to enable the development of research tools and the construction of a data base to be analyzed by researchers looking at different aspects of language development.

The Learning Lab

The Laboratory of Applied Cognitive and Ethnographic Studies has already been in existence for one year as the Centre for Applied Cognitive Science and Ethnographic Studies. The Centre recently received a \$1.25 million grant from the Québec government to conduct basic research and expand its facilities in the Education building on Peel Street.

The grant covers four areas of research: scientific text comprehension, problem solving in medicine, technical writing, and second language skills. Carl Fredriksen, the Centre's head, says that some of the most exciting research to come out of his lab is in cross-language text processing and simultaneous translation.

"Grass is obscene"

These corporations, he inferred, would not be greatly harmed by a change in the appropriation laws.

Water for household consumption is also subsidized, although less heavily than irrigation water. Bocking asserted that "to most consumers, whether urban or agricultural, water is so cheap that consuming it is not worth the bother." Similarly, polluting is cheaper than treating waste water.

While Bocking found no evidence of water shortage, he maintains

other desert plants rather than grass. Golf courses water with reclaimed sewer water. Tucson has cut water use per person to a third that used in Phoenix, an unmetered Arizona desert city. Irrigation water to low value crops is also being cut in the USA.

The facts support Bocking when he asserts that the USA is no longer interested in Canadian water. The "so-called need is man-made, and political, not biological or economic."

...nuclear energy

continued from page 3

Hydroelectric projects develop power through the displacement of very large bodies of water. Such hydroelectric power plants are massive and usually involve building directly into wilderness. Many Cree Indians were forced to move as a result of the James Bay project and large land masses were taken over by the Hydro-Québec developers. One of the largest examples of land exploitation for hydro projects can be found in Brazil. Several thousand acres of tropical rainforest are felled daily

for numerous projects, including hydro, with little regard to the potentially disastrous ecological impact.

Nuclear fuel waste has the advantage of being easily detected. A hand held Geiger counter can detect the smallest amounts of radioactive material. A great deal is also known about the handling of radioactive materials and new uses are being developed for nuclear waste. Since small amounts of waste result in large energy production it is cost effective to pay a

great deal of attention to the waste, a quality not shared by most other conventional energy producing mechanisms.

In choosing an energy production means, we are often forced to accept some form of trade off. In order to properly understand what social and ecological concessions are made one should attempt to objectively study all variables involved.

Public concern has forced the nuclear energy program in Canada to advance cautiously. Nuclear power production is a potentially hazardous endeavor and must be treated with an equal amount of caution so that we may minimize the concessions that we are forced to make.

news

Students protest sale of Apartheid

CFCF pushes Apartheid

by Chris Lawson

"This is South Africa:" — African drumbeats, a fast-paced soccer game, a herd of wild animals thundering across a grassy plain, blue sky, blazing sun and blinding white sand.

The South African Tourism Bureau wants your business. But you'll have to go to New York to give it to them. South African Airways is prohibited from landing in Canada. They can, however, advertise.

TV commercials depicting South Africa as an exciting, exotic vacation spot are airing on television

stations in Vancouver, Toronto and Montréal.

The ads recently aired on Montréal TV station CFCF. On Monday, between 30 and 50 people, mostly students from Concordia and McGill Universities, picketed outside the station to protest the station's running of the commercials.

The demonstration was also to protest South African ambassador Glenn Babb as a guest on The Brian Gizzard Show, a current events talkshow on CFCF.

"They are a client," said CFCF sales manager Bob Lamle, of South African Airways. "We treated them

like any other client. It's no different from any other ad to us." According to Lamle, the ads were approved by the CRTC and "carry no political message."

McGill South Africa Committee co-ordinator Nigel Crawhall disagrees. "It is different and they know it is. It's a question of violating international sanctions."

Says Crawhall, "You are never without a moral responsibility," something he feels CFCF is trying to deny.

CFCF's Brian Gizzard Show with Ambassador Babb aired last Tuesday. Dan Feldman, the show's producer, defended having the ambassador on the show. "Babb is a man in the news," he said. "It's a current events show. We try to have high profile guests."

But Feldman denies that having Babb on the show had anything to do with ratings. "If we were interested in ratings, we would have held the show back two weeks and promoted it to death."

He added, "I don't feel CFCF has been irresponsible at all." Feldman plans to do another show on South Africa from an anti-Apartheid point of view.

CFCF has no plans to cancel the South African Airways commercials.

themselves. Though the delay in SDI may not be a bad thing, it could also delay basic research in these areas.

Finally, there will not likely be a lot of benefits in spinoffs. "The only spinoff of space exploration is light weight camping blankets," Grogono said that military research, because of its secrecy, is generally "inefficient, expensive and leads to large reports that nobody reads." Furthermore, "advancement in the military is often based on management of such large projects" that the people making final critical decisions are biased and do not have the required knowledge.

Grogono remarked that "to prepare this lecture I had to take Star Wars seriously for a little while." He then revealed that he really does not take it seriously and urged that we "look at defense from a sociological not a technological standpoint."

"Defense comes from a peoples' sense of themselves, their morals and their ethics," he said.

Star Wars software

continued from page 1

Grogono explained that the most applied area of AI is expert systems. This requires learning from a human expert the methods s/he uses to convert them into a set of rules that can be implemented on a computer. There are no human experts on nuclear war, so this technique is useless here.

Grogono summarized the reasons why he is against SDI from a programming standpoint. He said he feels that, first of all, it is impossible to get accurate enough information about targets to ensure system accuracy. Secondly, it is not possible to extensively test SDI under realistic conditions. Programmes never work the first time — "will we get a second chance?"

In addition, the success of the programme does not depend merely on money or (wo)manpower. Rather, large research grants can actually hinder research since "the best researchers become administrators" placed in charge of a large staff of people less able than

...intelligence centre

continued from page 5

"This is an untouched field," he says.

Fredriksen's new interests focus his basic research on a higher level, extending to work on expert and sub-expert systems. This has direct application in the design of microcomputer based systems for such processes as medical diagnoses. Ultimately, Fredriksen wants to provide an intelligent tutor or a dependable tool that a diagnostician could use.

Ethnographic work at the Centre, under Tom Elsemont, John Galaty and Fredriksen, includes the study of cognitive skills in various populations, primarily in Kenya. They are looking at school related cognitive skills of Kenyan children "In a realistic context," in the tradition of Cole and Scribner's *Culture and Thought* thesis.

Whereas Cole's original work involved relocating subjects in laboratory setting, Fredriksen and his colleagues are using computer based cognitive models to analyse actual religious and scientific discourse in order to document the skills that these people have. According to Fredriksen, the aim of this research is to create a teaching curriculum more suited to their culturally distinct cognitive skills.

Fredriksen cited related work by Vimala Patel who is studying procedural knowledge acquisition by Masai tribesmen. Patel is observing how the Masai learn Oral Rehydration Therapy, a medical procedure currently being taught by the Kenyan Government that combats the effects of contaminated drinking water. Here, too, the research goal is to develop a curriculum more suited to the Masais' cognitive abilities.

"The purpose of this research," Fredriksen says, "is to save lives."

Both Seldenberg and Fredriksen stress that the most interesting aspect of the Cognitive Sciences Centre is its heterogenous makeup. While enabling research to proceed in directions not otherwise possi-

ble, this setup hopes to encourage research cooperation between existing facilities with the aim of obtaining greater funding than would be possible with smaller research units.

Seldenberg says the Centre will continue the activities begun by the Cognitive Sciences Group, including the technical reports and the colloquium series. Scheduled speakers this term include Ursula Bellugi from the Salk Institute and Zenon Pylyshyn from the University of Western Ontario.

letter

A Gentleman and a ?

To the Daily:

As students of Professor John Shingler we strongly object to Mark Warner's letter of February 5 in which he equates Professor Shingler's position on South African politics with racism. Having studied under Professor Shingler, we are of the opinion that if Mr. Warner's charge were to be considered by itself, it could at best be explained as the result of a grossly distorted and completely unfounded interpretation of Professor Shingler's views while at worst it could be considered blatantly libelous.

However, over the years Mark Warner has made no attempt to hide his ill feelings towards Professor Shingler and in this context we believe that Mr. Warner's unfounded charge was intended to stain the excellent reputation which Professor Shingler rightfully enjoys both as a gentleman and as a scholar.

Moreover, in light of the Daily's Statement of Principles in which you reserve the right to prohibit the publication of libelous material, the decision to publish Mr. Warner's letter points to yet another example of the reprehensible fashion in which the present Daily staff abuses its powers. Indeed in this case, the Daily appears to have violated articles 11.3.3 and 11.3.7 of its own constitution.

Howard Garson

Arts U3
Steven Smith, U3 Arts
Arnold Cohen, U2 Arts
David Kaufman, U3 Arts
Henry Mizrahi, U2 Arts
Ian Simmons, U3 Arts
Mark Copperstone, U3 Arts

ed. note: Mr. Warner's letter, though strongly worded, is not libelous.

events

CDAS and Dan O'Meara of CIDMAA will present *Crises of the South African State* 12h00-14h00 in the seminar room of 3715 Peel

Black Students' Network will hold a general meeting and film in Union 425-426 at 17h00

McGill Outing Club general meeting with an ice climbing film and discussions of horseback riding, skiing and winter camping will take place in Arts 160 at 19h30

Players Theatre needs actresses, actors for an up-coming production of *The Actor's Nightmare* by Christopher Durang. Auditions will be held in Players Theatre 13h00-16h00, tomorrow 15h00-18h00

McGill Film Society presents a free film *His Girl Friday* in Union Ballroom at 20h00 DESA (Department of English Students' Association) will hold a poetry reading by

Montréal poet-activist Mona Adilman at 15h00

Amnesty International will meet in the Newman Centre at 19h00

McGill Chaplaincy will have conversation and hot chocolate Around the Fireplace with Rev. Helmut Saabas and Rev. Andreas Desypris at 3484 Peel, call Alcida at 392-5890

McGill Committee for Studies on Aging and Professor D. Crawley will present *Changing Image of the Elderly in Mass Media* in Meakins Theatre of the MacIntyre Med. Bldg. at 16h00

CDAS and the YMCA Study Group will present *Hungry for Profit*, a documentary on famine and agribusiness, at 19h00 in the Stewart Biology Bldg.

Redpath Museum presentation on Mid-Cambrian fossils and the Burgess Shales of Mt. Wapta, B.C. at 15h00

Alpine Ski Team general meeting in Currie Gym COTC lounge at 16h30

McGill Entrepreneurs Club will host M.S. Imard from Invention Québec on *Inventions, Patents and Product Marketing in Bronfman 178* at 16h30

McGill Blood Drive '86 from 10h00 to 18h00 on the 6th floor of McIntyre Medical Bldg.

McGill Crossroads elections require a signed letter to be dropped off to the office by tomorrow at noon. Elections will follow Professor Karl Levitt speech on *The Third World Debt Problem* in Union 107-108 at 19h00.

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The Daily is a founding member of Canadian University Press (CUP), La Presse Étudiante du Québec (PEQ), and Campus Plus (CUP Media services).



classifieds

Ads may be placed through the Daily, Room 803, Student Union Building, 9 a.m. to 3 p.m. Deadline is 2:00 p.m. two weekdays prior to publication.

McGill students: \$2.50 per day; for 3 consecutive days, \$2.00 per day; more than 3 days, \$1.75 per day. McGill faculty and staff: \$3.50 per day. All others: \$4.00 per day. **Exact change only, please.**

The Daily assumes no financial responsibility for errors, or damage due to errors. Ad will re-appear free of charge upon request if information is incorrect due to our error. The Daily reserves the right not to print a classified ad.

341 — APTS., ROOMS, HOUSING

Sublet: large 3 1/2, conveniently located, clean, modern building, pool, sauna, furnished or unfurnished, option to renew. Available immediately. \$400-\$500. Call 844-6055.

Room for rent, everything included. Ask for Mike at 3479 Hutchison between 10 am and 7 pm. 5 min from campus.

Outremont: seek female roommate to share 6 1/2: \$175/month including heat, near 80 bus. 276-8290.

Male non-smoker wanted to share large bright 4 1/2 after Feb. 15th. \$225/mo. including heat. 3660 Peel St. Call Ethan 842-1971. Evenings.

Roommate wanted to share 8 1/2 room downtown house immediately (short or long term). Must be mature, non-smoking. Call Mike w-879-2624; h-844-9864

Large 2 1/2 apt Sublet for only \$270 from March 1. Option to renew. Bright, clean, heated, at Prince Arthur W. Call 695-7466 or 843-3880.

Immediately available for rent: nice and bright room in Westmount apt. 1 1/2 min. from Métro Vendôme. Call: 733-6962 (evenings) or leave message.

350 — JOBS

Animator/Researcher for a T.V. pilot. Send your resume to: M. Vezina, 849 de l'Eglise, Verdun H4G 2N4.

Brother/Sister pairs are needed for a three-hour study in the Department of Psychology. \$7/hr./person. Call 392-4689 weekdays and ask about the twin study. (Both twin and non-twin brother/sister pairs needed).

354 — TYPING SERVICES

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361 — ARTICLES FOR SALE

Hi-fi stereo amplifier and tuner Toshiba, plus loudspeakers; 40 Watts RMS P/C; \$600 value at \$325 Bargain price. Jean-Paul, 937-1397.

Compact Fridge XCLNT cond. \$90; 23"

B/W classic 60's tv \$50; Portable bar/2 stools \$70; Mattel Synsonics drum pad \$80; Remington manual typewriter \$50. 279-3711 midnight-noon.

Konica Autoreflex TC, 50 mm 1/1.8 Hexagon, 28 mm 1/3.5 Hexagon w/lens hood, Vivitar Series 1 70-210mm 1/3.5 zoom, cases, filters. \$400 or best offer. 392-8904 or 256-0043. Ask for Gina.

370 — RIDES

Anyone interested in sharing a ride to Miami, Florida, I'm leaving at the beginning of March. We will split expenses. Call Robert 659-0946.

372 — LOST & FOUND

Found: Piece of gold jewelry. Call

286-9985.

374 — PERSONAL

McGill Rugby: Thanks for a great tour, mates. Hands up and drink. Beads for all. From the Fat Boys and the Coral Tree Choir.

Dear Dailyites: You may wonder why I've called you all here today. Well, once again, things have gotten way out of hand. Mom is tired to death of cleaning up after you all. If something breaks, please leave the office staff a note about it—we're the ones who call the repairpeople. Even if it isn't a production night, **you are responsible for the space in which you work and the tools that you use, not**

Your mother

McGill Chaplaincy Services Host

Around the Fireplace

CONVERSATION and HOT CHOCOLATE

COME AND WARM YOURSELVES BY THE FIRE with a cup of hot chocolate on the house

Join us in informal discussions with McGill Chaplains

Rev. Helmut Saabas, Lutheran

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Come on the following days:

4:00 Wed., Feb. 26

Noon Tue., Mar. 4

4:00 Wed., Mar. 5

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Topics to be selected from:

Child Abuse & Incest: How to break the chains

Detecting Prejudice Among Ourselves

Does God Speak to Us in Dreams?

Scrupes: Let's try this new game or use it as a springboard for discussion.

Care of the Body vs Care of the Spirit

Euthanasia

PGSS NOTICE

NOTICE OF CONSTITUTIONAL AMENDMENT

(To be considered by PGSS Council March 5, 1986)

Be it resolved that "secretary" in the PGSS Constitution and By-laws be amended to read "Vice-President, Administration" except in:

- (i) the second occurrence in Article 15, section 1 (j)
- (ii) By-law 3, Part II, section 3 (b)

Are you called to be this woman?

A Sister of the Congregation of Notre Dame is:

- a woman with a sense of purpose in her life. A person who strives to live simply, prayerfully, humanly, lovingly with and for others. Who wishes to be filled with that same joy and compassion to which Mary herself gave witness.
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Talk to a Sister of the Congregation of Notre Dame or write or call:

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ND in formation

383 — LESSONS OFFERED

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Flute and recorder lessons, cours de flûte traversière et flûte à bec. Theory and rhythm for beginners or advanced. Call 388-5164.

Portuguese speaking graduate student would like to exchange Portuguese for French lessons. Roberto. 392-4493

385 — NOTICES

Spectrum! Don't miss this 3-screen, 9-projector, multi-image experience with

music by Bruce Cockburn, Eurythmics, Police, Thompson Twins, and more. Friday, Feb. 28, 8:00 p.m. in Leacock 132.

Auditions for Ann Jellicoe's The Knack: Feb. 26, 27, 28—5-8 p.m. in the Morrice Hall classroom (M021). Presented by Tuesday Night Café Theatre.

387 — VOLUNTEERS

Advanced Actors Needed to play in a video production on the Algerian War of Liberation. 1) Afro-American 20-40; 2) 3-5 boys, 13-15 of roughly North African origin. Serious applications only: Julian 284-0431.

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Academic advising is available by appointment.



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PGSS ELECTIONS

RE-OPENING of NOMINATIONS

Nomination forms available at Thomson House
Nominations close 5 pm, February 28, 1986

Advance Polls: March 10, 11, and 12
Election Day: March 13, 1986

POSITIONS RE-OPENED FOR NOMINATION
Should no nominations be made, PGSS Council will appoint representatives on March 5, 1986

Senator (Academic)
Board of Governors Representative

The term of office is:
June 1, 1986 to May 31, 1987

For more information contact
KAREN SHAW, PGSS CRO
849-4318 or 392-5899

Applications for Deputy Returning Officers may be made at the door of Thomson House (There is a small honorarium for DROs)

Nominations for Speaker of PGSS Council have been extended to March 5, 1986 (6:30 pm)

Black History Supplement tomorrow

All P&P members are invited to discuss financial matters today at noon. Please attend.

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MCGILL ARTS & SCIENCE

UNDERGRADUATE SOCIETY

ELECTIONS

Nominations are being called for all positions on the Arts and Science Executive Council for the year 1986-87. Nomination forms are available at the Arts and Science Undergraduate Society Office in the Stephen Leacock Bldg., Room 319. The following positions are open:

PRESIDENT
VICE PRESIDENT (FINANCE)
VICE PRESIDENT (ARTS)
VICE PRESIDENT (SCIENCE)
SECRETARY
MEMBER-AT-LARGE (ARTS) (2)
MEMBER-AT-LARGE (SCIENCE) (2)
ARTS REPRESENTATIVE (2)
SCIENCE REPRESENTATIVE (2)

Nominations close Friday, March 7, 1986 at 5:00 pm

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PINK FLOYD
THE POLICE
and others

Fri. Feb. 28, 8:00 p.m.

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Friday March 14, '86

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